

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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# MULTIMEDIA UNIVERSITY

## FINAL EXAMINATION

TRIMESTER 1, 2019/2020

**PPH0255 – PHYSICS**

(Foundation in Information Technology)

17 October 2019  
2.30 P.M – 4.30 P.M  
(2 Hours)

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### INSTRUCTIONS TO STUDENT

1. This question paper consists of 4 printed pages with 5 questions only, excluding the cover page, physical constants, and formula list.
2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.

## LIST OF PHYSICAL CONSTANTS

|                             |              |                                                                      |
|-----------------------------|--------------|----------------------------------------------------------------------|
| Acceleration due to gravity | $g$          | $9.80 \text{ m/s}^2$                                                 |
| Electron mass               | $m_e$        | $9.11 \times 10^{-31} \text{ kg}$                                    |
| Proton mass                 | $m_p$        | $1.67 \times 10^{-27} \text{ kg}$                                    |
| Elementary Charge           | $e$          | $1.602 \times 10^{-19} \text{ C}$                                    |
| Coulomb Constant            | $k$          | $9.0 \times 10^9 \text{ N m}^2 \cdot \text{C}^{-2}$                  |
| Permittivity of free space  | $\epsilon_0$ | $8.85 \times 10^{-12} \text{ C}^2 \text{N}^{-1} \cdot \text{m}^{-2}$ |

## LIST OF FORMULA

### NEWTONIAN MECHANICS

$$\omega = \frac{\Delta\theta}{\Delta t}$$

$$v = r\omega$$

$$a = r\alpha$$

$$\omega = \omega_0 + \alpha t$$

$$\theta = \frac{1}{2}(\omega_0 + \omega)t$$

$$\theta = \omega_0 t + \frac{1}{2}\alpha t^2$$

$$\omega^2 = \omega_0^2 + 2\alpha\theta$$

$$\theta = \omega t - \frac{1}{2}\alpha t^2$$

$$W = Fs \cos\theta$$

$$KE = \frac{1}{2}mv^2$$

$$PE_G = mgy$$

$$P = \frac{W}{t} = \frac{E}{t} = \frac{Fd}{t} = F\bar{v}$$

$$p = mv$$

$$\sum F = \frac{\Delta p}{\Delta t}$$

$$m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$$

$$m_1 u_1 + m_2 u_2 = (m_1 + m_2) v$$

## ELECTRICITY

$$q = Ne$$

$$F = k \frac{q_1 q_2}{r^2}$$

$$E = \frac{F}{q_o}$$

$$E = k \frac{q}{r^2}$$

$$\Phi = EA \cos \theta$$

$$\Phi_c = \frac{q_{in}}{\epsilon_o}$$

$$V = \frac{U}{q_o}$$

$$V = \frac{kq}{r}$$

$$U = k \frac{q_1 q_2}{r_{12}}$$

$$C = \frac{\epsilon_o A}{d}$$

$$Q = CV$$

$$C = \kappa C_0$$

$$C_{eq} = C_1 + C_2 + \dots$$

$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \dots$$

$$V = Ed$$

$$U = \frac{1}{2} QV$$

$$U = \frac{1}{2} CV^2$$

$$U = \frac{Q^2}{2C}$$

$$u_E = \frac{1}{2} \epsilon_o E^2$$

$$I_{av} = \frac{\Delta Q}{\Delta t}$$

$$V = IR$$

$$R = \rho \frac{L}{A}$$

$$R_{eq} = R_1 + R_2 + \dots$$

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$$

$$P = IV$$

$$P = I^2 R$$

$$P = \frac{V^2}{R}$$

$$V = E - Ir$$

**STRUCTURED QUESTIONS [50 MARKS]**

**Instructions:** Answer **ALL** questions in this section.

**Question 1 [10 marks]**

- a. The angular speed of an automobile engine is increased from 1200 rev/min to 3000 rev/min in 12 s.
- What is its angular acceleration in  $\text{rev/min}^2$ , assuming it to be uniform? (2 marks)
  - How many revolutions does the engine make during this time? (2 marks)
- b. The flywheel of an engine is rotating at 25 rad/s. When the engine is turned off, the flywheel decelerates at a constant rate and comes to rest after 20.0 s. Calculate
- the angular acceleration (in  $\text{rad/s}^2$ ) of the flywheel. (2 marks)
  - the angle (in radian) through which the flywheel rotates in coming to rest, and (2 marks)
  - the number of revolutions made by the flywheel in coming to rest. (2 marks)

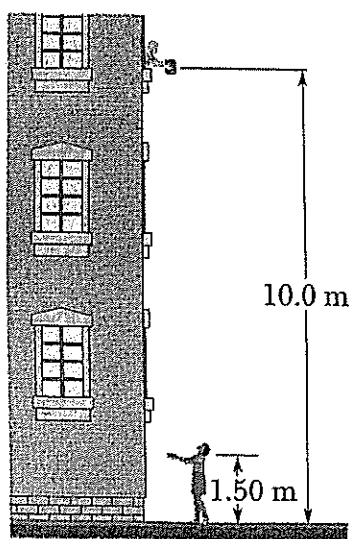
**Question 2 [10 marks]**

**Figure Q2(a)**

- a. You drop a 2.0 kg textbook to a friend who stands on the ground 10.0 m below the textbook with outstretched hand 1.50 m above the ground (**Figure Q2(a)**).

**Continued...**

- i. How much work is done on the textbook by its weight as it drops to your friend's hands? (2 marks)

If the gravitational potential energy of that system is taken to be zero at ground level, what is its potential energy when the textbook

- ii. is released and (1 mark)
- iii. reaches the hands? (1 mark)
- iv. What is the change in the gravitational potential energy of the textbook-Earth system during the drop? (1 mark)
- b. A 6.0 kg box sled is coasting across frictionless ice at a speed of 9.0 m/s when a 12.0 kg package is dropped into it from above.
- i. What is the new speed of the sled? (2 marks)
- ii. What are the initial and final kinetic energies of the system? (3 marks)

**Question 3 [10 marks]**

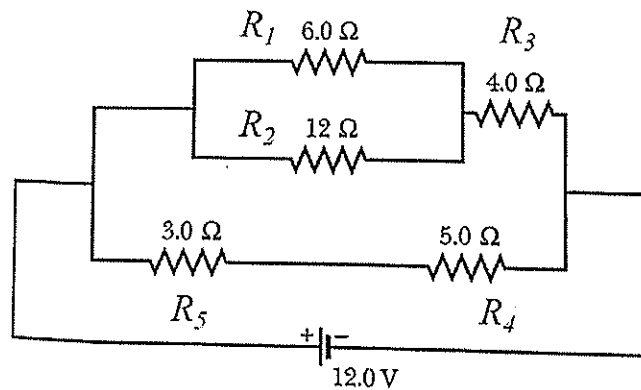
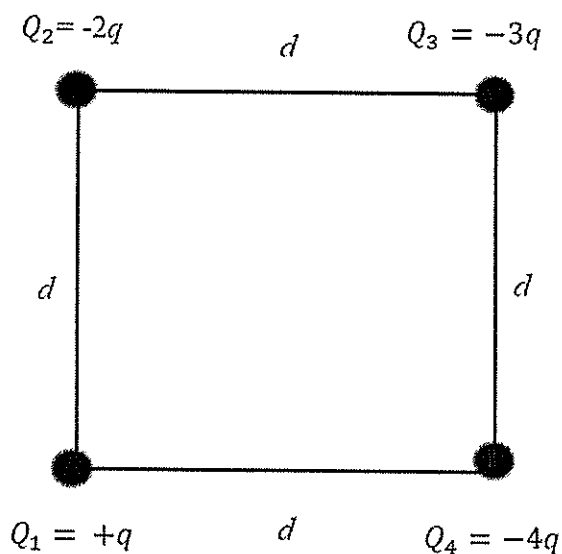


**Figure Q3**

For the circuit in **Figure Q3** calculate,

- a. the equivalent resistance. (4 marks)
- b. the current flowing through the  $R_5$  resistor. (2 marks)
- c. the potential difference across the  $R_5$  resistor. (2 marks)
- d. the power dissipated by the  $R_5$  resistor. (2 marks)

**Continued...**

**Question 4 [10 marks]****Figure Q4**

Four point charges are located at the corners of a square with sides of length,  $d = 20.0$  cm. (**Figure Q4**)

- Find the direction and the magnitude of the net electrostatic force exerted on the point charge  $Q_1$ . Let  $q = 1.0 \mu\text{C}$  (8 marks)
- How would your answers to part 4(a) change if the distance  $d$  were doubled? (2 marks)

**Question 5 [10 marks]**

- Define 'free electrons' and 'valence electrons'. (1mark)
- With the aid of a diagram, describe the formation of holes in a  $p$ -type semiconductor. (3 marks)

Continued...

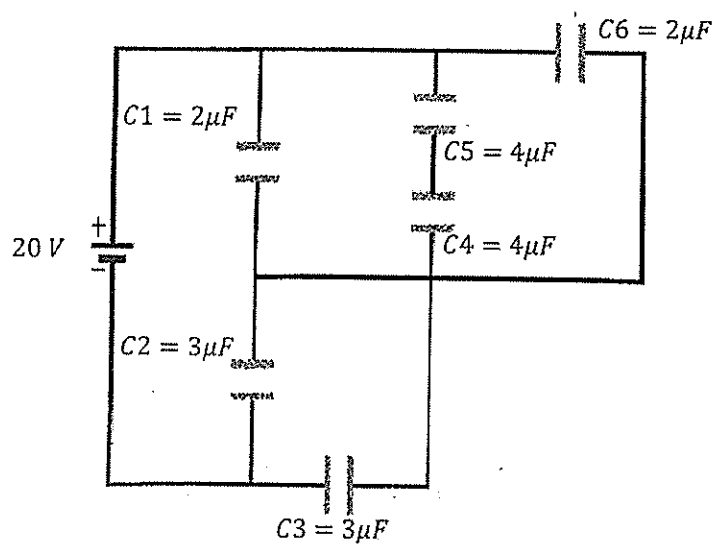


Figure Q5(c)

- c. Six capacitors are connected as shown in **Figure Q5(c)**. Calculate
- the equivalent capacitance of all the capacitors. (5 marks)
  - the charge stored on that equivalent capacitance. (1 mark)

End of Paper